Smart Band

By

Team 13 - May 10 , 2016

Team 13 Members

We are Smart Trak Solutions

Tom Ou Yang (CEO)

Peter Le (CAO)

Ashton Novak-Louie (CTO)

Farah Ferdous Ishita (COO)

Agenda

SMARTTRAK SOLUTIONS

Introduction

Motivation

System Overview

Market Analysis

Challenges

Conclusion & Questions

Original Scope

SMARTTRAK SOLUTIONS

"What can go wrong, will go wrong."

-Murphy's Law

- Original plans: We had originally planned to use a prebuilt wristband and utilize the built-in sensors to develop a mobile safety application, but had to adjust our project scope during April 1
- What changed: Build our own hardware to meet design elements

Motivation - The Problem

SMARTTRAK SOLUTIONS

- Main problem: If a fall takes place and no one can is nearby
- Each year, between 20-30% of seniors fall each and is the leading cause for injury related hospitalizations among Canadian seniors[5]
- Full time caretaker are very expensive
- Senior citizens want independence
- Family members and friends want a sense of security for their loved ones

Motivation - Proposed Solution

SMARTTRAK SOLUTIONS

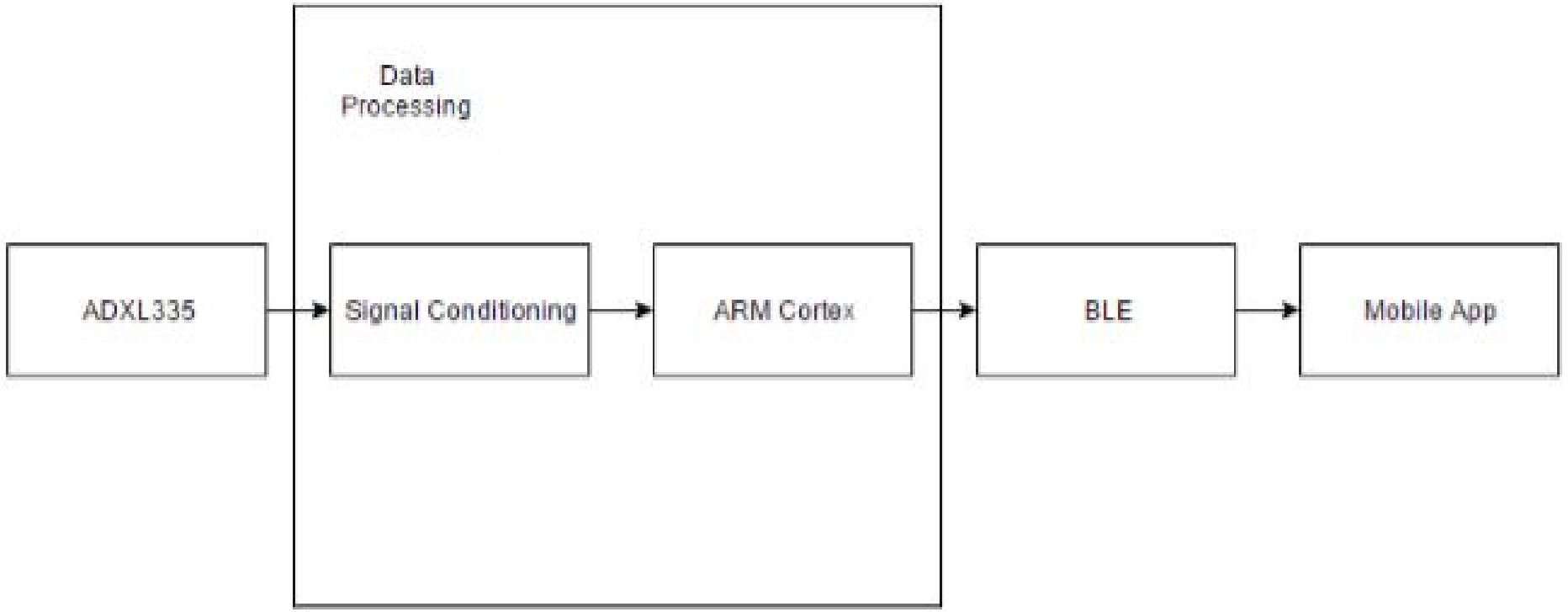
- Create an affordable solution with advanced features
- Functions as a secondary safety device
- Integrate with either a smartphone or a mobile base station
- Ability to detect severe falls
- Automatically sends SMS SOS messages
- GPS Location service

System Overview - High Level Design

SMARTTRAK SOLUTIONS

System Overview - Block Diagram

SMARTTRAK SOLUTIONS

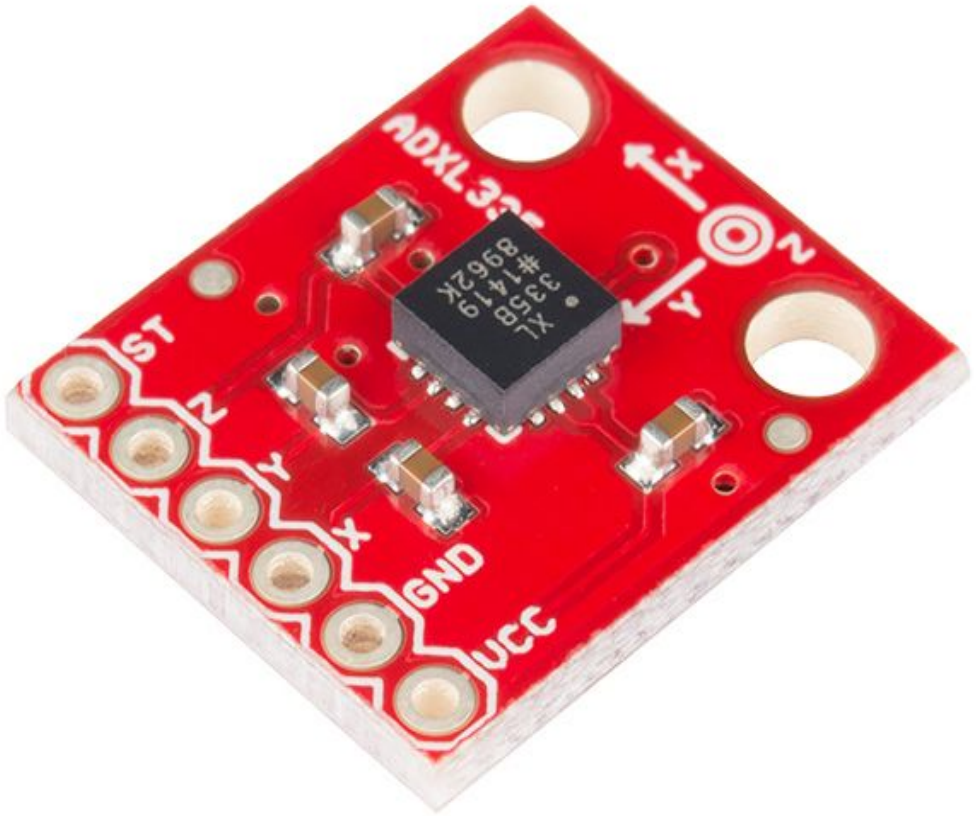


System Overview - Hardware

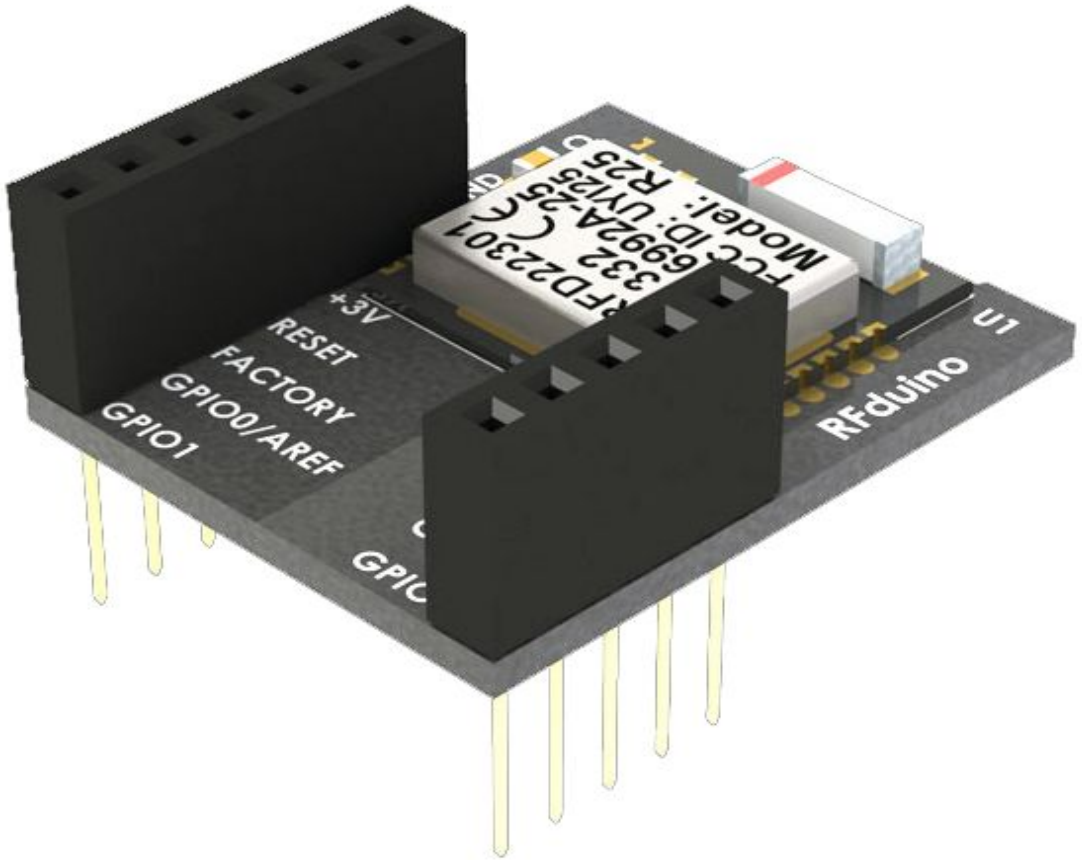
SMARTTRAK SOLUTIONS

Key features:

- Low power consumption
- High accuracy for a MEMs based sensor
- Low cost



System Overview - Hardware



Key features:

- Low power consumption
- Supports the Arduino library
- BLE enabled
- Small & compact
- High degree of customization

System Overview - Fall Detection

SMARTTRAK SOLUTIONS

1) Free Fall
2) Velocity > Threshold value (0.7m/s)
3) Impact
4) Inactivity (about 5 second)

If all these condition are met, the system will assume the user has fallen and cannot get up or has fallen unconscious. If that is the case, the RFduino will transmit a BLE signal

Mobile Application

SMARTTRAK SOLUTIONS

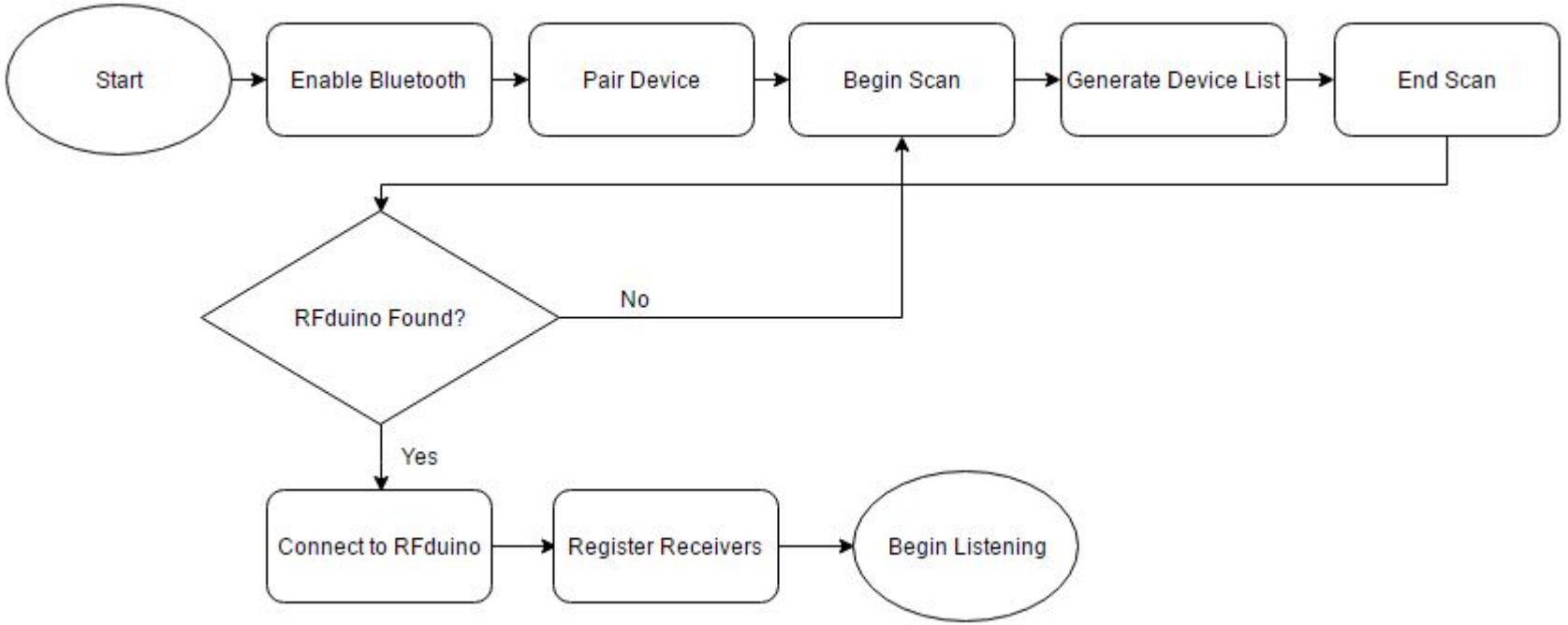
- Simple to use
  - Intuitive UI
- Lightweight
  - Memory usage
  - Battery usage
- Set and forget
  - Runs smoothly in background
- Manual panic button

Mobile Application Technical Details

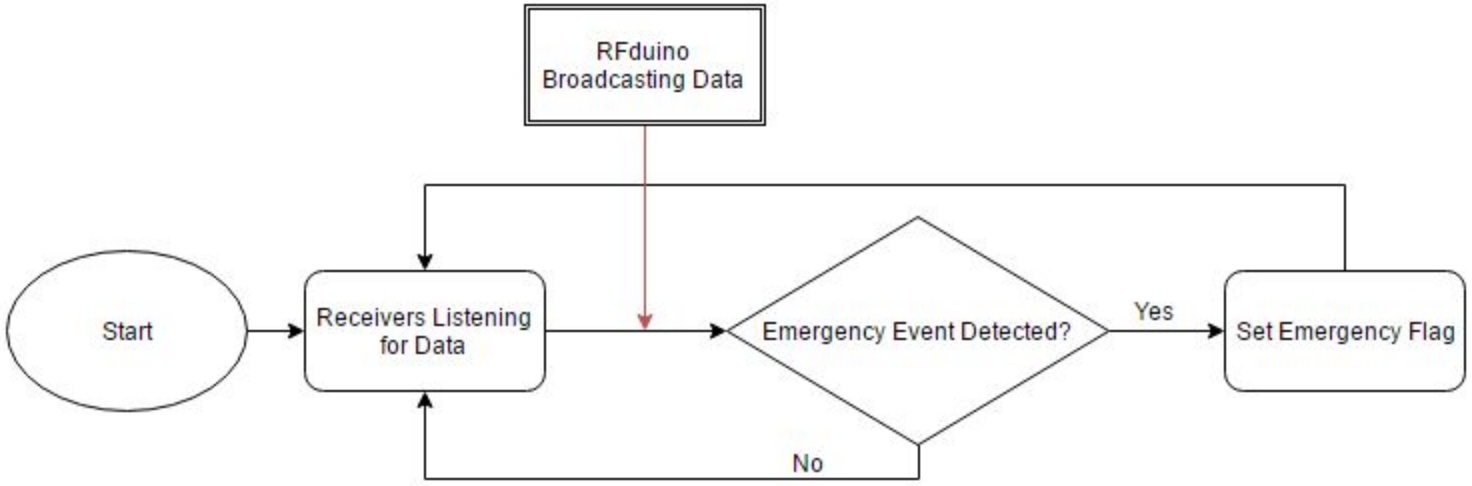
SMARTTRAK SOLUTIONS

- Android platform
- Minimum Android SDK 18 for RFduino
- Bluetooth Low Energy (BLE)
- Permissions:
  - Bluetooth
  - Bluetooth Admin
  - Send SMS
  - Access Coarse Location
  - Access Fine Location
  - Vibrate
  - Read Contacts

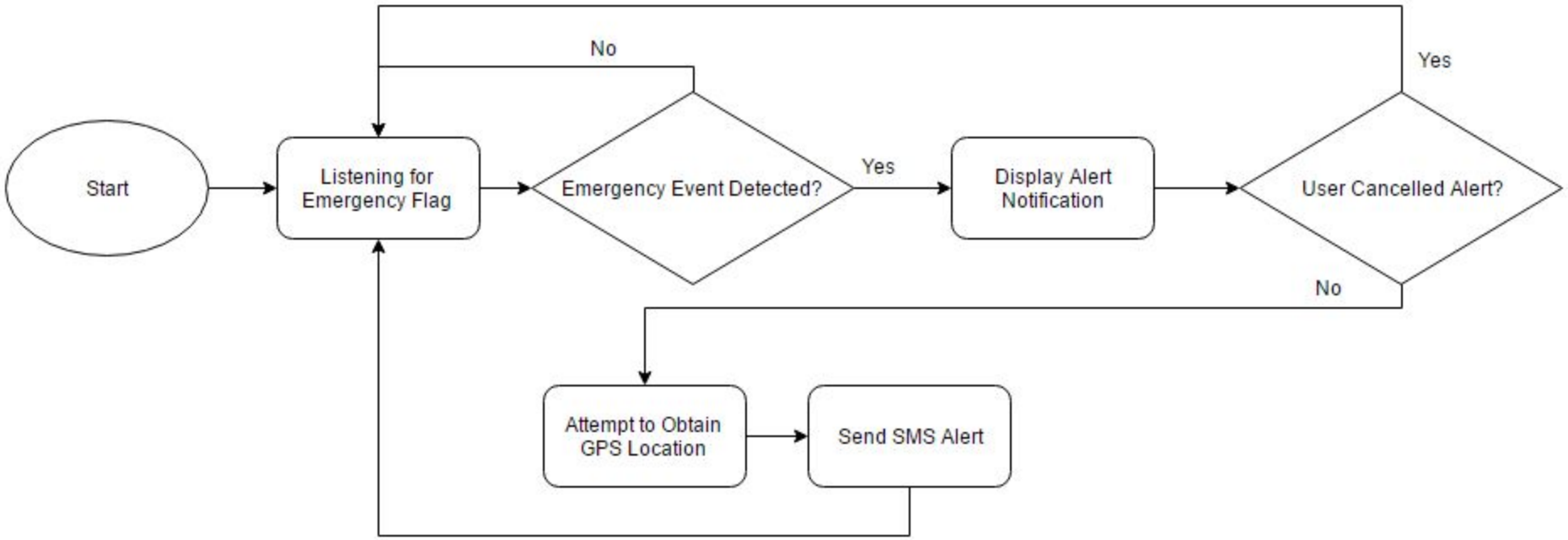
Bluetooth Connection Flow



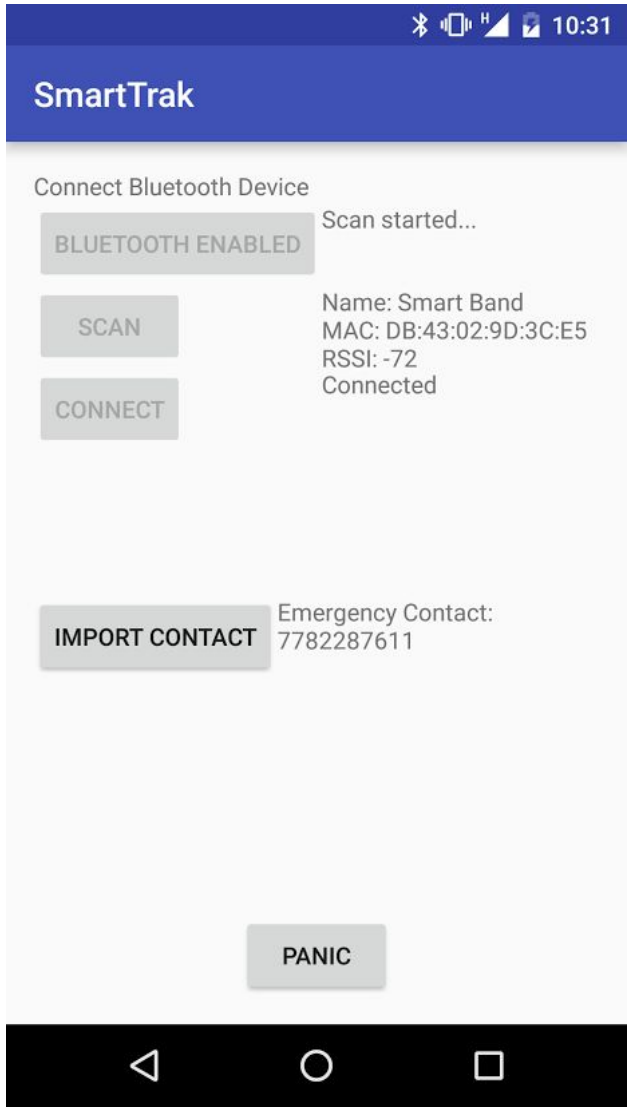
Bluetooth Data Flow

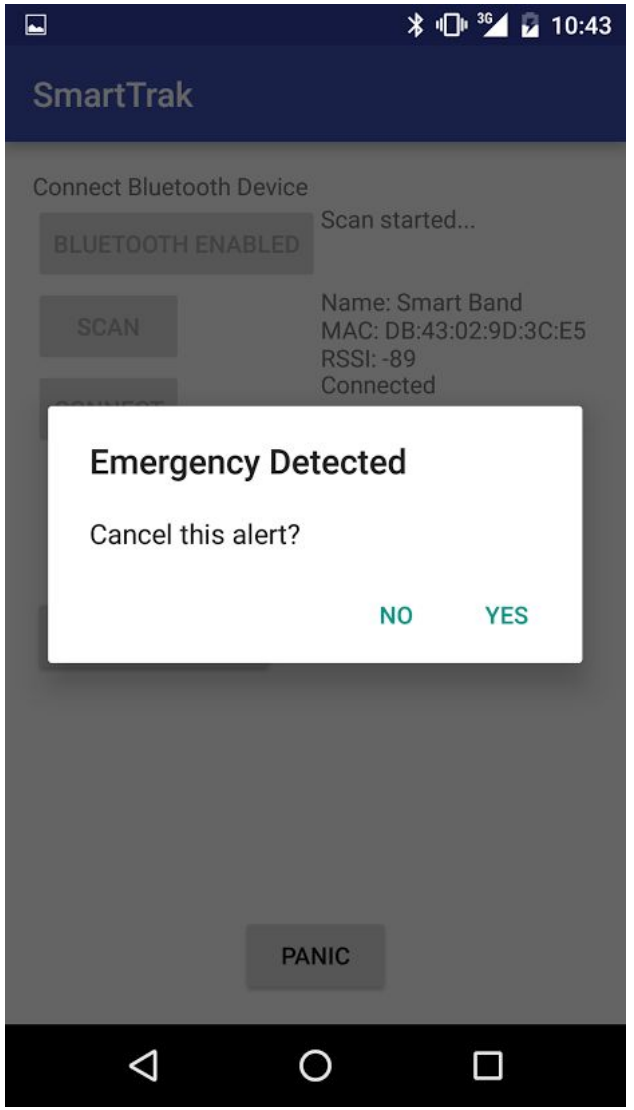


Emergency Event Flow

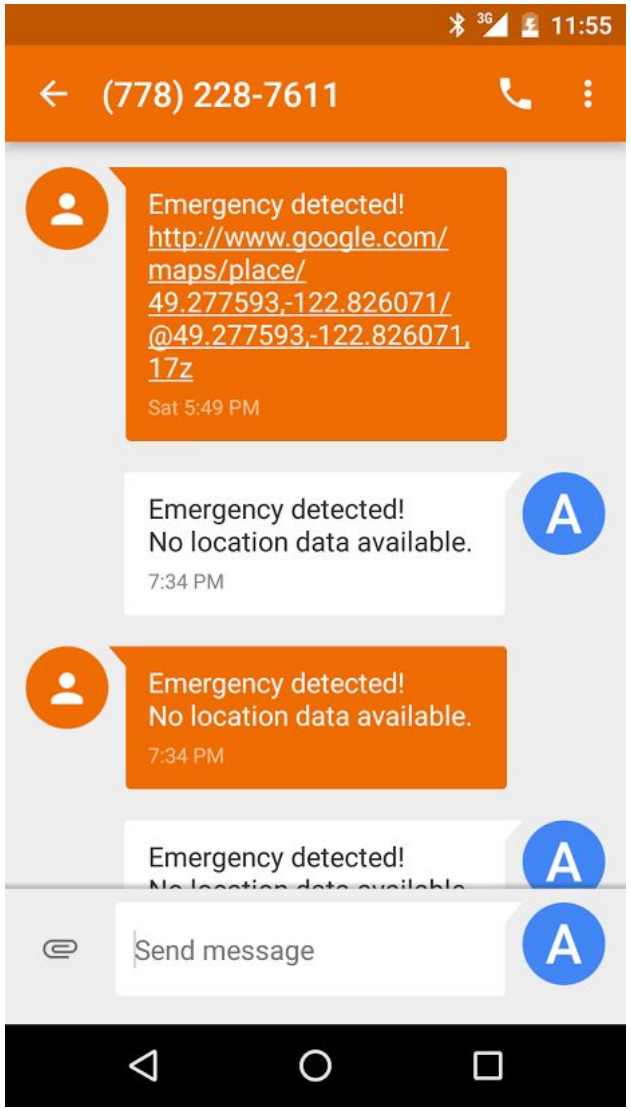


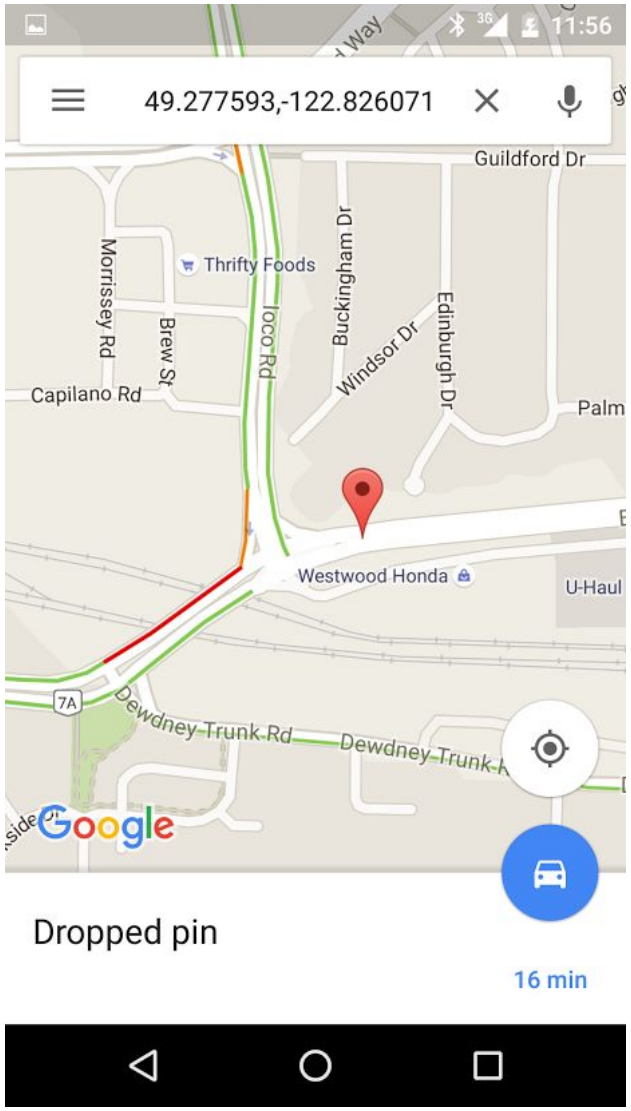
User Interface





Emergency Alert





Price & Financing

RFduino Development Kit	$55.79
ADXL Accelerometer	$20.86
Lithium Ion Polymer Battery	$15.35
USB Extension Cables (testing purposes)	$17.88
Protoboard	$2.19
Metal Case	$6.71
Shipping Costs	$25
Total Cost	**$143.78**

Need to apply for Wighton Fund since our ESSEF fund went to MS Band 2

Estimated Costs

Manufacturing Costs

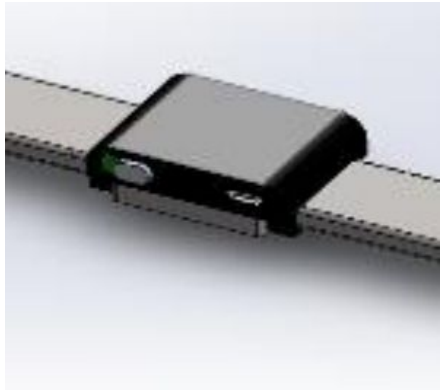
- Accelerometers & BLE modules $10/unit * 2
- LED’s, resistors, wiring & solder $5/unit
- PCB boards $0.50/unit
- Microcontroller $1/unit
- Manufacturing Labour Costs $60/unit
- Design Labour Costs (pay us) $40/unit
- Distribution costs $10/unit (allow sellers to make $10 profit)

Total Proposed Market Price $131.99 USD

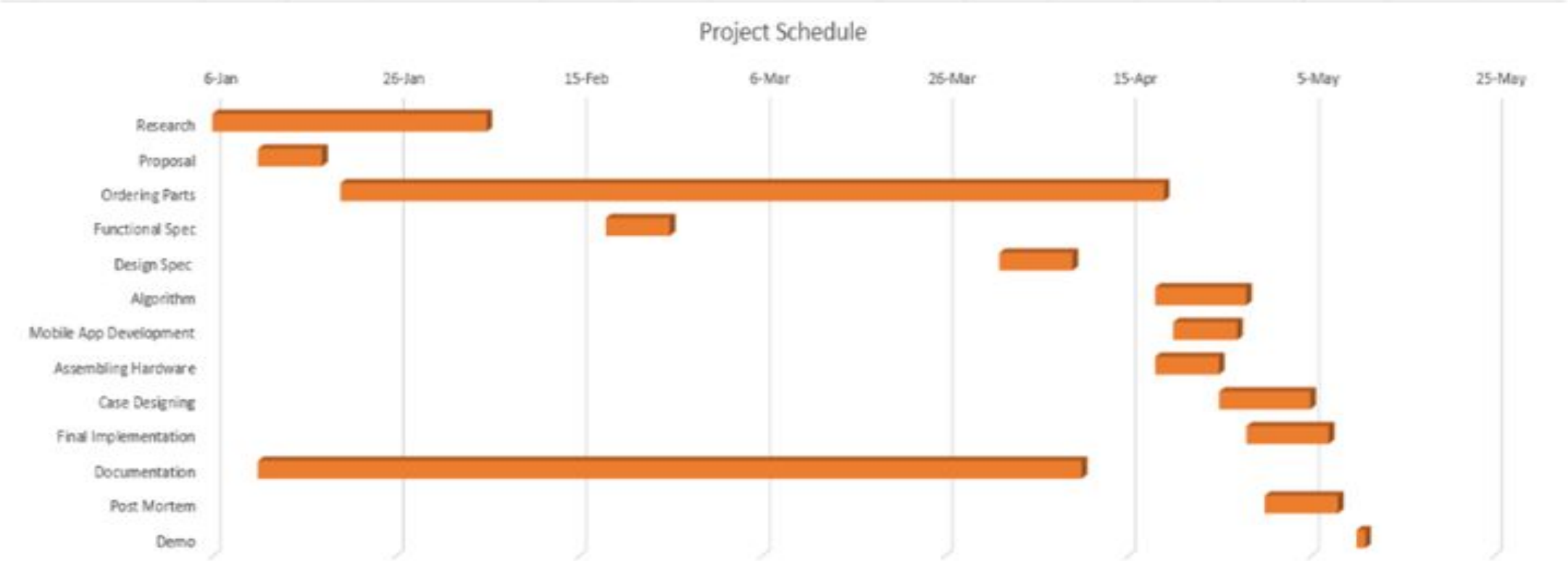
Market & Competition

Product Name	Smart Trak Solutions Smart Band	ATS Medical Alert System	UnaliWear Kanega Watch	Amulyte
Emergency Panic Button	✔	✔		✔
Ability to send GPS location	✔		✔	✔
Automatic Response to Fall Detection	✔	✔	✔	
Worn around/on	Wrist	Neck	Wrist	Neck

Market & Competition

Product Name	Smart Trak Solutions Smart Band	ATS Medical Alert System	UnaliWear Kanega Watch	Amulyte
Image				
Communication Method	Uses network from mobile phone	Uses mobile/home phone line	Cellular antenna built in	Cellular antenna built in
Base Price	132 USD	299 USD	299 USD	149 USD
Monthly Fee	0	0	35 USD	29.99 USD

Schedule



	Demo	Post Mortem	Documentation	Final Implementation	Case Designing	Assembling Hardware	Mobile App Development	Algorithm	Design Spec	Functional Spec	Ordering Parts	Proposal	Research
Start Date	10-May	30-Apr	11-Jan	28-Apr	25-Apr	18-Apr	20-Apr	18-Apr	1-Apr	18-Feb	20-Jan	11-Jan	6-Jan
Days to Complete	1	8	90	9	10	7	7	10	8	7	90	7	30

Non- Technical Challenges

SMARTTRAK SOLUTIONS

- Budget
- Time management
- Lack of one group member
- Team meeting

Technical Challenges

SMARTTRAK SOLUTIONS

- Adding design components in a short period of time
- Getting familiar with Android Studio
- Not knowing exactly which parts to order
- Assembling hardware components in a very small case
- Soldering really short wires for case designing
- Designing panic button for the wrist band case
- Reassembling hardware the day before demo due date

Future Implementation

SMARTTRAK SOLUTIONS

- Secure additional funding to implement other features
- E-ink screen display to show the time; function more like a wrist watch
- Reduce hardware size
- Add charging ports to easily recharge the battery (usb or induction charging)
- Add functionality to update firmware wirelessly
- Adjust algorithm to increase robustness
- Add additional algorithm to check for edge cases

Learning Outcomes

SMARTTRAK SOLUTIONS

- We learned more advanced coding syntax in Java and C++
- Used Calculus II knowledge to implement integral calculus on microcontroller with code
- Learned how to code for boards in the Arduino Family
- Gained experience in writing professional project documents

Outcomes of Goals

SMARTTRAK SOLUTIONS

- We achieved our goal of creating a wearable smart device that would detect falls.
- Achieved our personal goals of making ourselves more well versed with Java and C++ coding languages
- Achieved our personal goals of applying our electronics and electrical engineering knowledge to create a consumer electronic device

Acknowledgements

Dr Andrew Rawicz

Mr. Steven Whitmore

Dr Ash Parameswaran

Hsiu- Yang Tseng,

Jamal Bahari

Mona Rahbar,

Soroush Haeri

Mahssa Abdollahi

Conclusion

- Implement algorithm on ARM microcontroller
- Designed housing unit before commencing data acquisition
- Re-collected fall data and determined appropriate threshold for fall detection
- Eventually got our prototype working

Questions?

References

[1] http://www.rfduino.com/product/rfd22102-rfduino-dip/index.html#tab-description

[1a] http://www.digikey.ca/product-detail/en/rf-digital-corporation/RFD90101/1562-1011-ND/5056358

[2] https://www.sparkfun.com/datasheets/Components/SMD/adxl335.pdf

[2a] http://www.digikey.ca/product-detail/en/sparkfun-electronics/SEN-09269/1568-1044-ND/5140809

[3] https://www.rpelectronics.com/af-258-lithium-ion-polymer-reachargeable-battery-3-7v1200mah.html

[4] http://imgur.com/yREjv65

[5] http://www.phac-aspc.gc.ca/seniors-aines/publications/public/injury-blessure/seniors_falls-chutes_aines/index-eng.php